PRODUCT BRIEF

# XENSIV™ TCI-R

## Infineon's thermal conductivity A2L refrigerant gas sensor

Automotive and industrial HVAC manufacturers are increasingly using alternative refrigerants that are classified as mildly flammable (A2L) or flammable (A3). This shift introduces new safety risks related to refrigerant leakage, prompting standards like UL 60335-2-40 and IEC 60335-2-40 to require Refrigerant Detection Systems (RDS) for specific refrigerant loads and room sizes.

The TCI-R sensor, which detects refrigerants using the thermal conductivity principle, is a vital component of an RDS. Compared to other detection technologies, the TCI-R sensor provides low power consumption and fast response time, making it ideal for continuous monitoring. Its versatility is demonstrated by the ability to detect a broad range of refrigerants, including R32, R454A, R454B, R454C, R455A, R1234yf, and R744 ($CO_2$), all common in modern HVAC systems. When a leak is detected, the system can automatically trigger safety measures such as activating fans to dilute refrigerant, improving safety for occupants and ensuring regulatory compliance. As manufacturers shift toward low-GWP refrigerants, the TCI-R sensor plays an essential role in safe, reliable HVAC operation.

Infineon's XENSIV™ TCI-R refrigerant gas sensor operates using thermal conductivity (TC) and a differential MEMS sensor design. By measuring the heat transfer through gases by heating parts of the MEMS structure, TC sensing ensures robust, stable performance in tough automotive and industrial conditions. Unlike chemical sensors, TC sensors use a physical principle, making them immune to sensor poisoning and high offset drift, resulting in greater reliability.

**Potential applications**

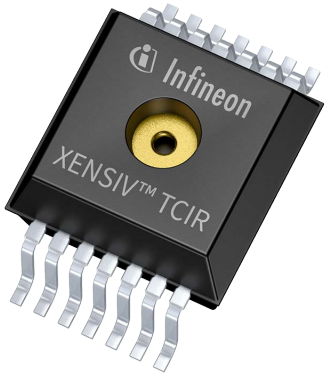
– Automotive refrigerant leakage measurement
– General industrial refrigerant gas leakage measurement

### Key features

– Insensitivity to poisoning
– Low lifetime offset drift
– Calibrated for R32, R454A/B/C, R455A, R1234yf, and $CO_2$
– Low power consumption
– UL recognition (UL60335-2-40/89)
– 15 years lifetime
– AEC-Q100, Grade2 qualified
– JEDEC, JESD47L, JESD22 and JSTD-020 qualified

### Key benefits

– No maintenance or replacement costs
– Robustness and stability
– No field recalibration needed




RoHS cULus AEC Qualified

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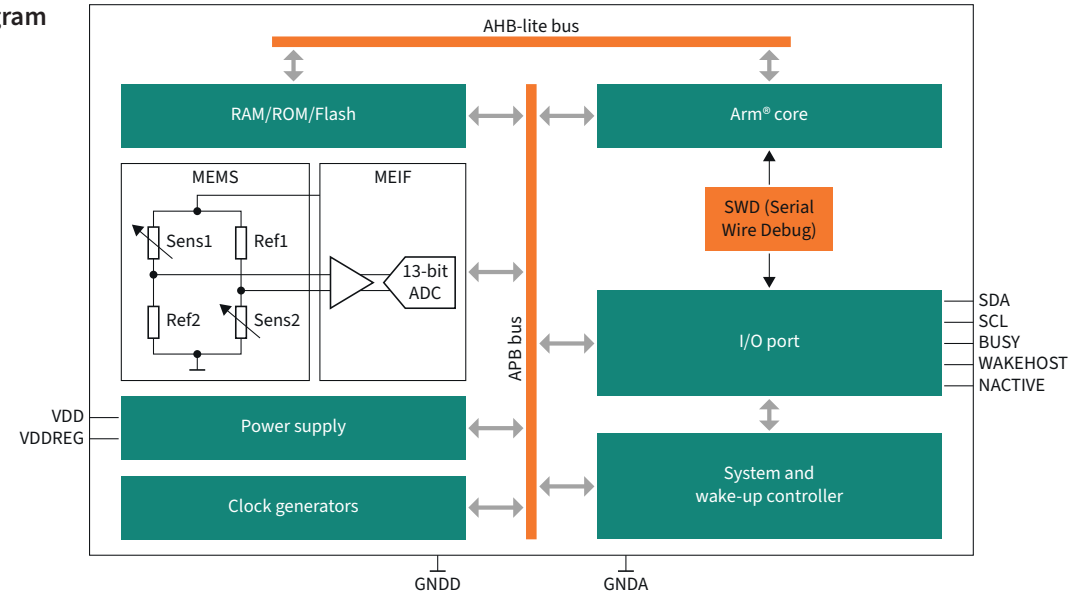
## Block diagram




## Product overview

| Parameter | Min. | Typ. | Max. | Unit | Note or test condition |
|---|---|---|---|---|---|
| **A2L measurement range** | 0 | | 100 | %LFL | In air |
| **A2L accuracy** | -2.5 | | +2.5 | %LFL | 15°C ≤ $T_{amb}$ ≤ 25°C, 86 kPa ≤ $p_{GAS}$ ≤ 108 kPa, 30% < RH ≤ 70% |
| | -5 | | 5 | %LFL | -40°C ≤ $T_{amb}$ ≤ 85°C, 86 kPa ≤ $p_{GAS}$ ≤ 108 kPa, max dew point 40°C |
| **$CO_2$ measurement range** | 0 | | 25 | % | In air |
| **$CO_2$ accuracy** | -0.5 | | 0.5 | vol% $CO_2$ | $c_{CO2}$ ≤ 2 vol%, 80 kPa ≤ $p_{GAS}$ ≤ 120 kPa, -35°C ≤ $T_{amb}$ ≤ 40°C |
| | -2 | | 2 | vol% $CO_2$ | $c_{CO2}$ ≤ 12 vol%, 80 kPa ≤ $p_{GAS}$ ≤ 120 kPa, 50°C < $T_{amb}$ ≤ 105°C, RH > 10% |
| **Temperature operating range** | -40 | | 105 | °C | |
| **Relative humidity range** | 0 | | 100 | % | Non-condensing |
| **Avg. current consumption** | | 2.2 | | mA | |
| **Measurement time** | 3 | 4 | 5 | s | |

Note: Tolerance of external sensors used for compensation: ±1.5%RH, ±1°C, ±2 kPa

| Orderable Part Number (OPN) | Ordering code (SP number) |
|---|---|
| **TCIRXTMA1** | SP006185783 |

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